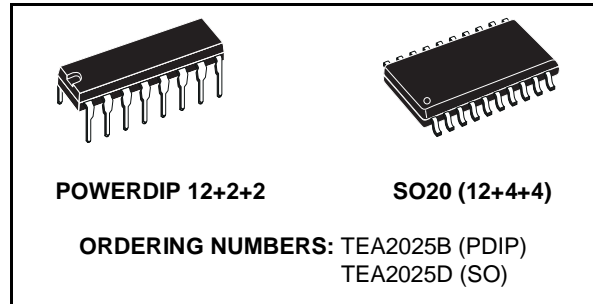


## STEREO AUDIO AMPLIFIER

- DUAL OR BRIDGE CONNECTION MODES
- FEW EXTERNAL COMPONENTS
- SUPPLY VOLTAGE DOWN TO 3V
- HIGH CHANNEL SEPARATION
- VERY LOW SWITCH ON/OFF NOISE
- MAX GAIN OF 45dB WITH ADJUST EXTERNAL RESISTOR
- SOFT CLIPPING
- THERMAL PROTECTION
- $3V < V_{CC} < 15V$
- $P = 2 \bullet 1W, V_{CC} = 6V, R_L = 4\Omega$
- $P = 2 \bullet 2.3W, V_{CC} = 9V, R_L = 4\Omega$
- $P = 2 \bullet 0.1W, V_{CC} = 3V, R_L = 4\Omega$



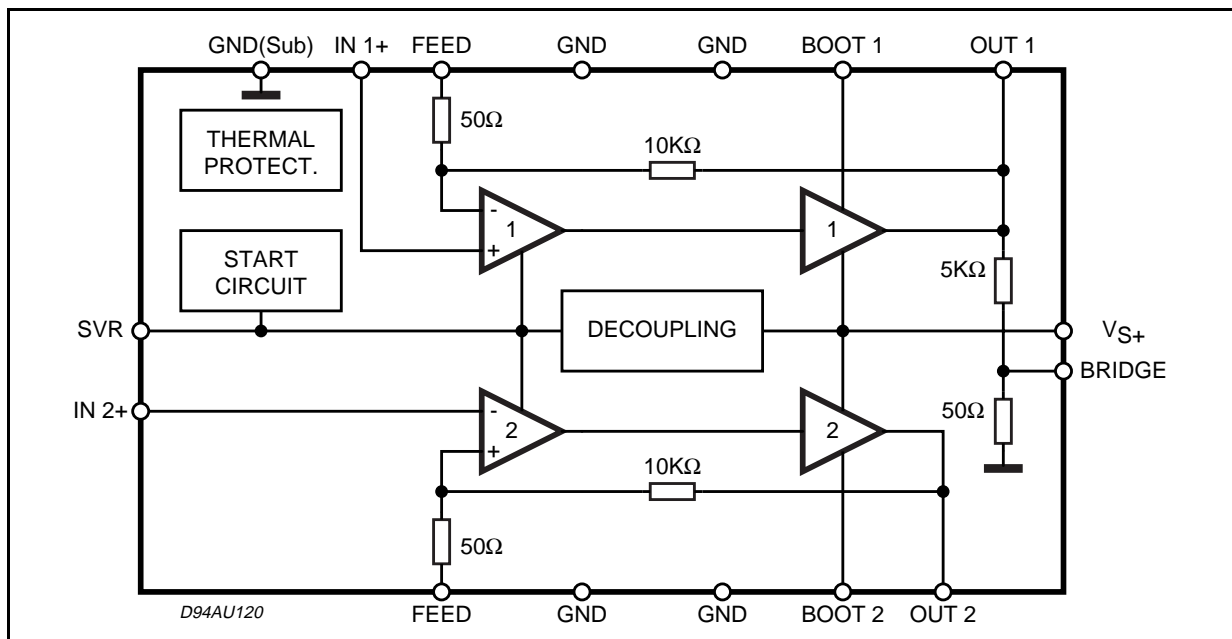
### DESCRIPTION

The TEA2025B/D is a monolithic integrated circuit in 12+2+2 Powerdip and 12+4+4 SO, intended for use as dual or bridge power audio amplifier portable radio cassette players.

### ABSOLUTE MAXIMUM RATINGS

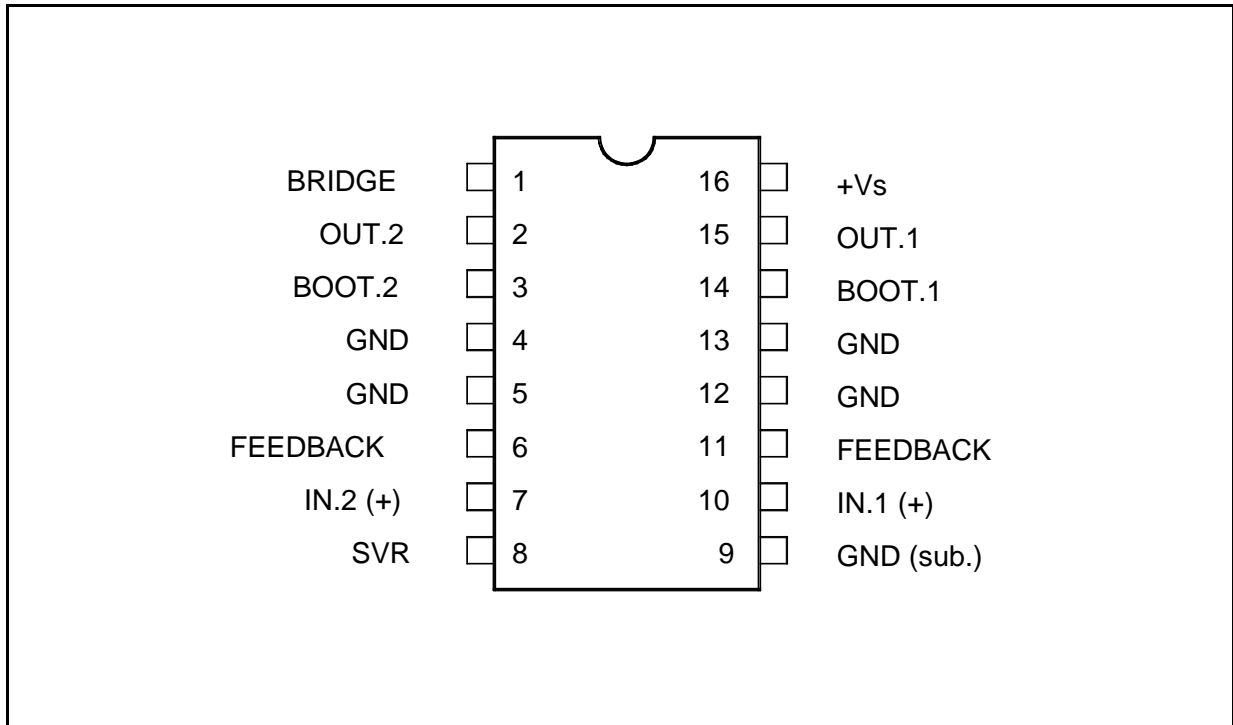
Symbol	Parameter	Test Conditions	Unit
$V_s$	Supply Voltage	15	V
$I_o$	Output Peak Current	1.5	A
$T_j$	Junction Temperature	150	°C
$T_{stg}$	Storage Temperature	150	°C

### BLOCK DIAGRAM

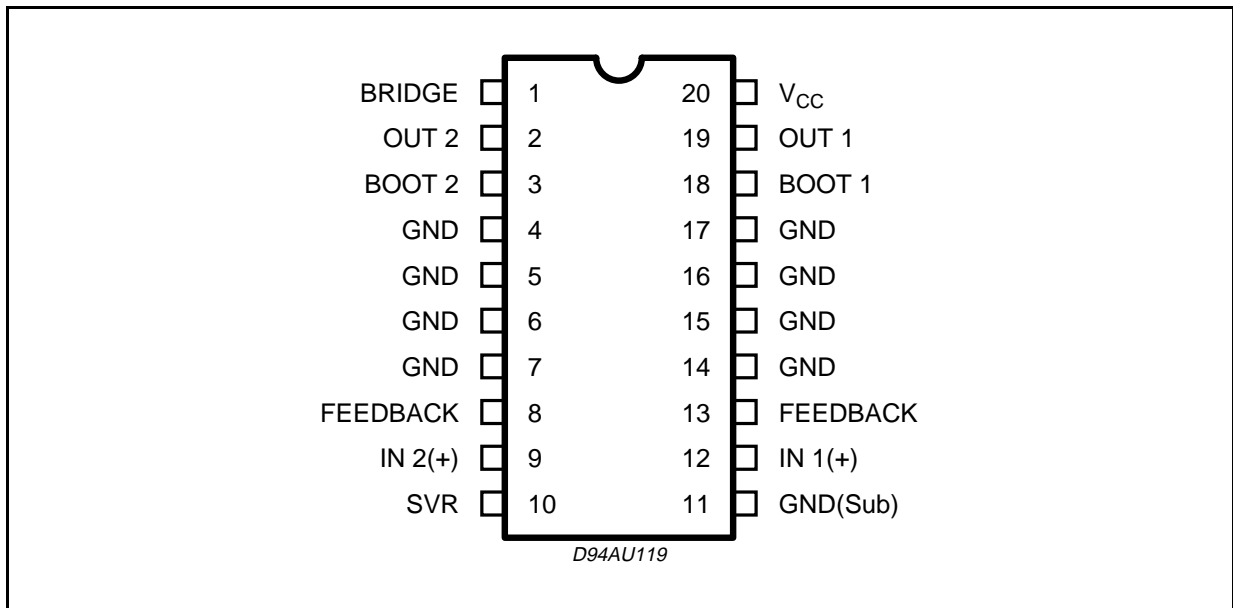


## TEA2025B - TEA2025D

### POWERDIP 12+2+2 PIN CONNECTION (Top view)



### SO 12+4+4 PIN CONNECTION (Top view)



### THERMAL DATA

Symbol	Description		SO 12+4+4 (*)	PDIP 12+2+2 (**)	Unit
$R_{th\ j-case}$	Thermal Resistance Junction-case	Max	15	15	$^{\circ}C/W$
$R_{th\ j-amb}$	Thermal Resistance Junction-ambient	Max	65	60	$^{\circ}C/W$

(\*) The  $R_{th\ j-amb}$  is measured with 4sq cm copper area heatsink

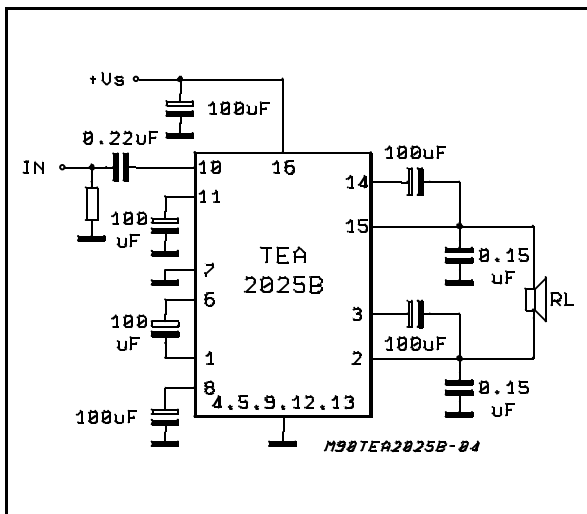
(\*\*) The  $R_{th\ j-amb}$  is measured on devices bonded on a 10 x 5 x 0.15cm glass-epoxy substrate with a 35 $\mu$ m thick copper surface of 5 cm<sup>2</sup>.

**ELECTRICAL CHARACTERISTICS** ( $T_{amb} = 25^{\circ}C$ ,  $V_{CC} = 9V$ , Stereo unless otherwise specified)

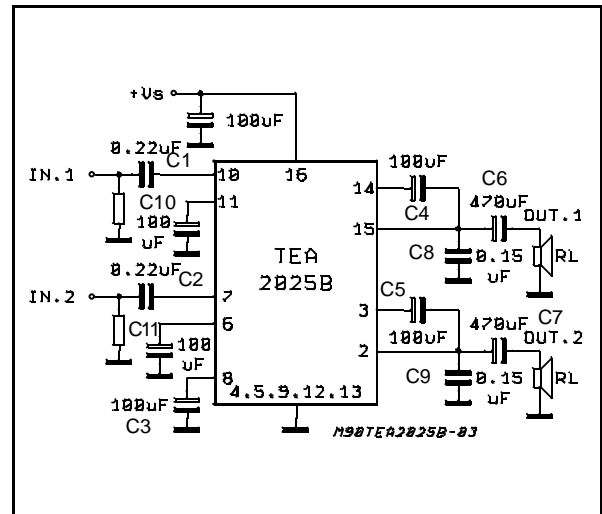
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_S$	Supply Voltage		3		12	V
$I_Q$	Quiescent Current			35	50	mA
$V_O$	Quiescent Output Voltage			4.5		V
$A_V$	Voltage Gain	Stereo Bridge	43 49	45 51	47 53	dB
$\Delta A_V$	Voltage Gain Difference				$\pm 1$	dB
$R_i$	Input Impedance			30		K $\Omega$
PO	Output Power (d = 10%)	Stereo 8 (per channel)	9V 4 $\Omega$	1.7	2.3	W
			9V 8 $\Omega$	0.7	1.3	
			6V 4 $\Omega$		1	
			6V 8 $\Omega$		0.6	
			6V 16 $\Omega$		0.25	
			6V 32 $\Omega$		0.13	
			3V 4 $\Omega$		0.1	
			3V 32 $\Omega$		0.02	
		Bridge	9V 8 $\Omega$			4.7
			6V 4 $\Omega$		2.8	
			6V 8 $\Omega$		1.5	
			3V 16 $\Omega$		0.18	
			3V 16 $\Omega$		0.18	
			3V 32 $\Omega$		0.06	
d	Distortion	$V_S = 9V$ ; $R_L = 4\Omega$ Stereo Bridge		0.3 0.5	1.5	%
SVR	Supply Voltage Rejection	$f = 100Hz$ , $V_R = 0.5V$ , $R_G = 0$	40	46		dB
$E_{N(IN)}$	Input Noise Voltage	$R_G = 0$ $R_G = 10\ 4\Omega$		1.5 3	3 6	mV
CT	Cross-Talk	$f = 1KHz$ , $R_G = 10K\Omega$	40	52		dB

Term. N° (PDIP)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
DC VOLT (V)	0.04	4.5	8.9	0	0	0.6	0.04	8.5	0	0.04	0.6	0	0	8.9	4.5	9

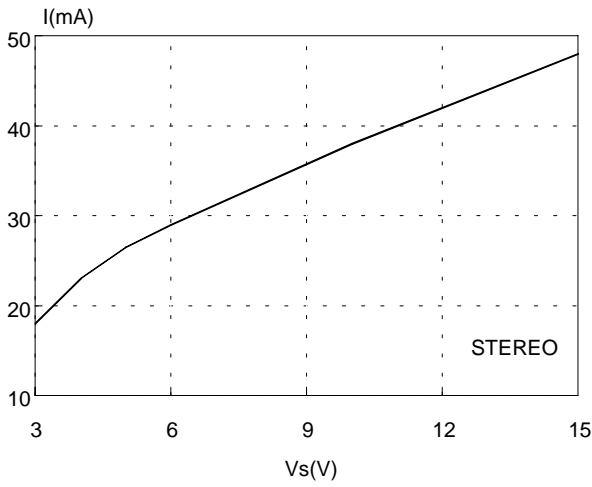
**Figure 1: Bridge Application (Powerdip)**



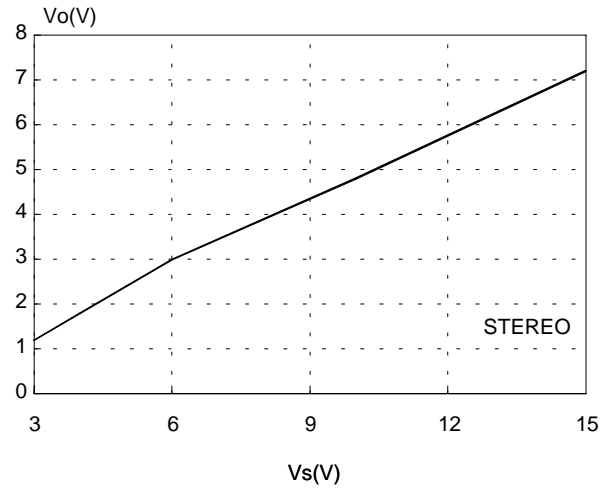
**Figure 2: Stereo Application (Powerdip)**



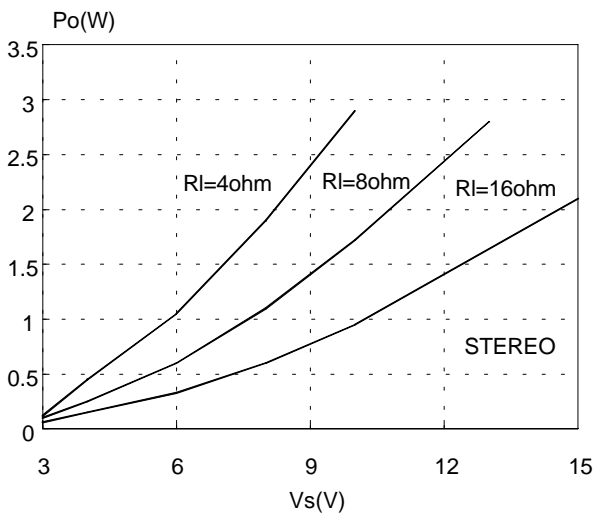
**Figure 3: Supply Current vs. Supply Voltage**  
( $R_L = 4\Omega$ )



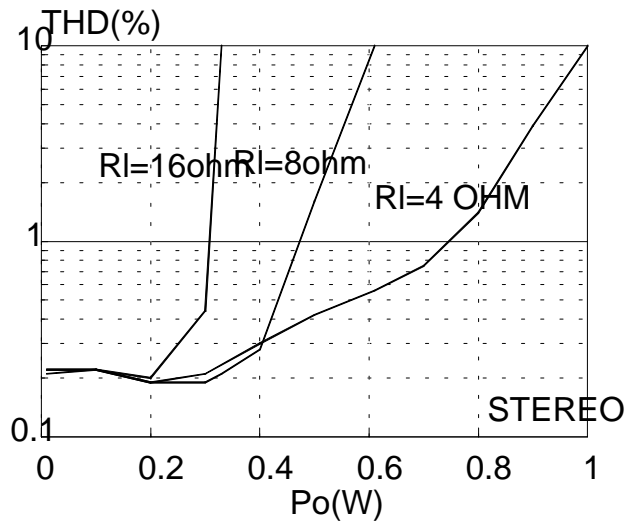
**Figure 4: Output Voltage vs. Supply Voltage**



**Figure 5: Output Power vs. Supply Voltage**  
(THD = 10%,  $f = 1\text{KHz}$ )



**Figure 6: THD versus Output Power**  
( $f = 1\text{KHz}$ ,  $V_s = 6\text{V}$ )



**APPLICATION INFORMATION**

**Input Capacitor**

Input capacitor is PNP type allowing source to be referenced to ground.

In this way no input coupling capacitor is required. However, a series capacitor (0.22 uF) to the input side can be useful in case of noise due to variable resistor contact.

**Bootstrap**

The bootstrap connection allows to increase the output swing.

The suggested value for the bootstrap capacitors (100uF) avoids a reduction of the output signal also at low frequencies and low supply voltages.

**Voltage Gain Adjust**

**STEREO MODE**

The voltage gain is determined by on-chip resistors R1 and R2 together with the external RfC1 series connected between pin 6 (11) and ground.

The frequency response is given approximated by:

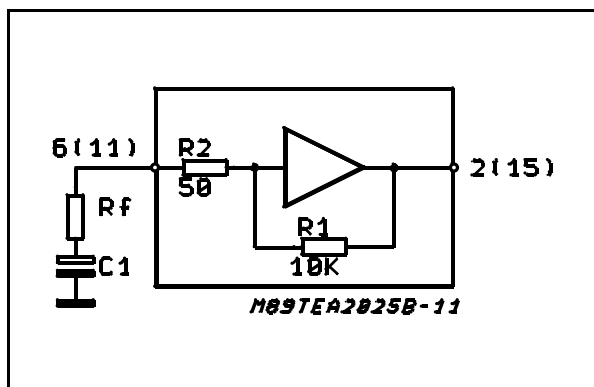
$$\frac{V_{OUT}}{V_{IN}} = \frac{R1}{Rf + R2 + \frac{1}{JWC1}}$$

With Rf=0, C1=100 uF, the gain results 46 dB with pole at f=32 Hz.

THE purpose of Rf is to reduce the gain. It is recommended to not reduce it under 36 dB.

**BRIDGE MODE**

**Figure 7**



The bridge configuration is realized very easily thanks to an internal voltage divider which provides (at pin 1) the CH 1 output signal after reduction. It is enough to connect pin 6 (inverting input of CH 2) with a capacitor to pin 1 and to connect to ground the pin 7.

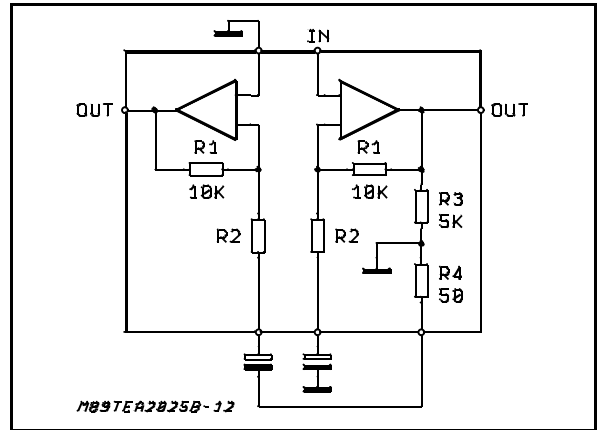
The total gain of the bridge is given by:

$$\frac{V_{OUT}}{V_{IN}} = \frac{R1}{Rf+R2 + \frac{1}{JWC1}} \left(1 + \frac{R3}{R4} \frac{R1}{R2+R4 + \frac{1}{JWC1}}\right)$$

and with the suggested values (C1 = C2 = 100 μF, Rf= 0) means:

Gv = 52 dB

**Figure 8**



with first pole at f = 32 Hz

**Output Capacitors.**

The low cut off frequency due to output capacitor depending on the load is given by:

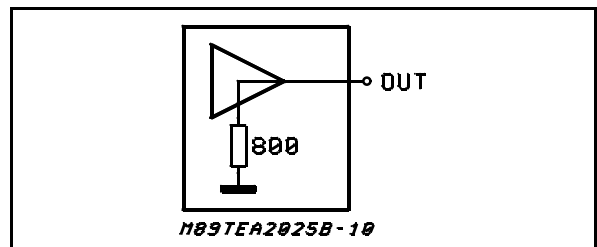
$$F_L = \frac{1}{2 \pi C_{OUT} \cdot R_L}$$

with C<sub>OUT</sub> 470μF and R<sub>L</sub> = 4 ohm it means F<sub>L</sub> = 80 Hz.

**Pop Noise**

Most amplifiers similar to TEA 2025B need external resistors between DC outputs and ground in order to optimize the pop on/off performance and crossover distortion.

**Figure 9**



The TEA 2025B solution allows to save components because of such resistors (800 ohm) are included into the chip.

## TEA2025B - TEA2025D

### Stability

A good layout is recommended in order to avoid oscillations.

Generally the designer must pay attention on the following points:

- Short wires of components and short connections.
- No ground loops.
- Bypass of supply voltage with capacitors as nearest as possible to the supply I.C.pin. The low value (polyester) capacitors must have good temperature and frequency characteristics.

- No sockets.

2) the heatsink can have a smaller factor of safety compared with that of a conventional circuit. There is no device damage in the case of excessive junction temperature: all that happens is that  $P_O$  (and therefore  $P_{tot}$ ) and  $I_d$  are reduced.

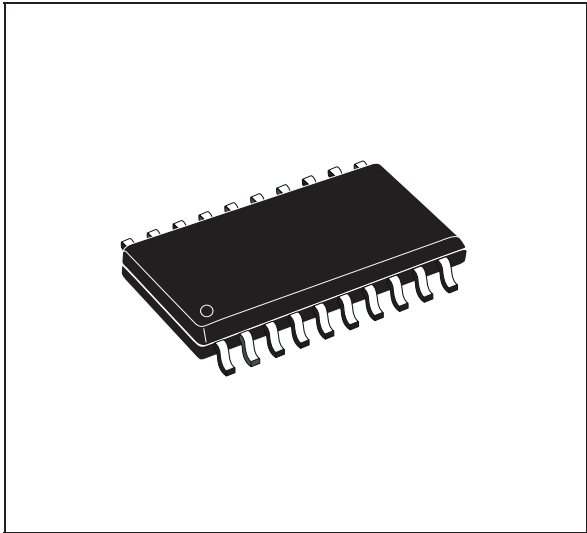
### APPLICATION SUGGESTION

The recommended values of the components are those shown on stereo application circuit of Fig. 2 different values can be used, the following table can help the designer.

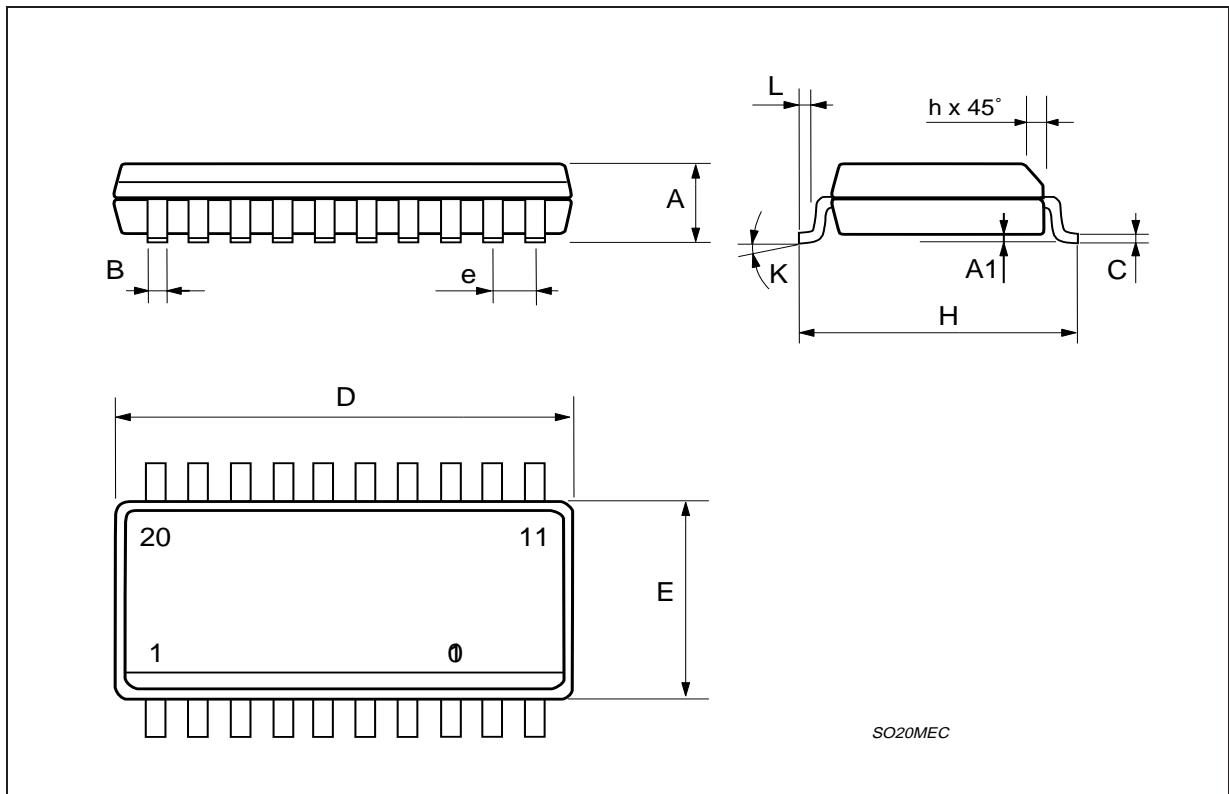
COMPONENT	RECOMMENDED VALUE	PURPOSE	LARGER THAN	SMALLER THAN
C1,C2	0.22 $\mu$ F	INPUT DC DECOUPLING IN CASE OF SLIDER CONTACT NOISE OF VARIABLE RESISTOR		
C3	100 $\mu$ F	RIPPLE REJECTON		DEGRADATION OF SVR, INCREASE OF THD AT LOW FREQUENCY AND LOW VOLTAGE
C4,C5	100 $\mu$ F	BOOTSTRAP		
C6,C7	470 $\mu$ F	OUTPUT DC DECOUPLING		INCREASE OF LOW FREQUENCY CUT-OFF
C8,C9	0.15 $\mu$ F	FREQUENCY STABILITY		DANGER OF OSCILLATIONS
C10, C11	100 $\mu$ F	INVERTING INPUT DC DECOUPLING		INCREASE OF LOW FREQUENCY CUT-OFF

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	2.35		2.65	0.093		0.104
A1	0.1		0.3	0.004		0.012
B	0.33		0.51	0.013		0.020
C	0.23		0.32	0.009		0.013
D	12.6		13	0.496		0.512
E	7.4		7.6	0.291		0.299
e		1.27			0.050	
H	10		10.65	0.394		0.419
h	0.25		0.75	0.010		0.030
L	0.4		1.27	0.016		0.050
K	0° (min.)8° (max.)					

**OUTLINE AND MECHANICAL DATA**



**SO20**

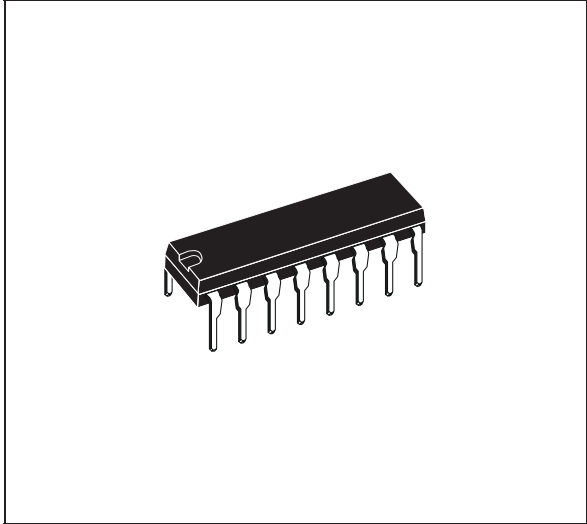


SO20MEC

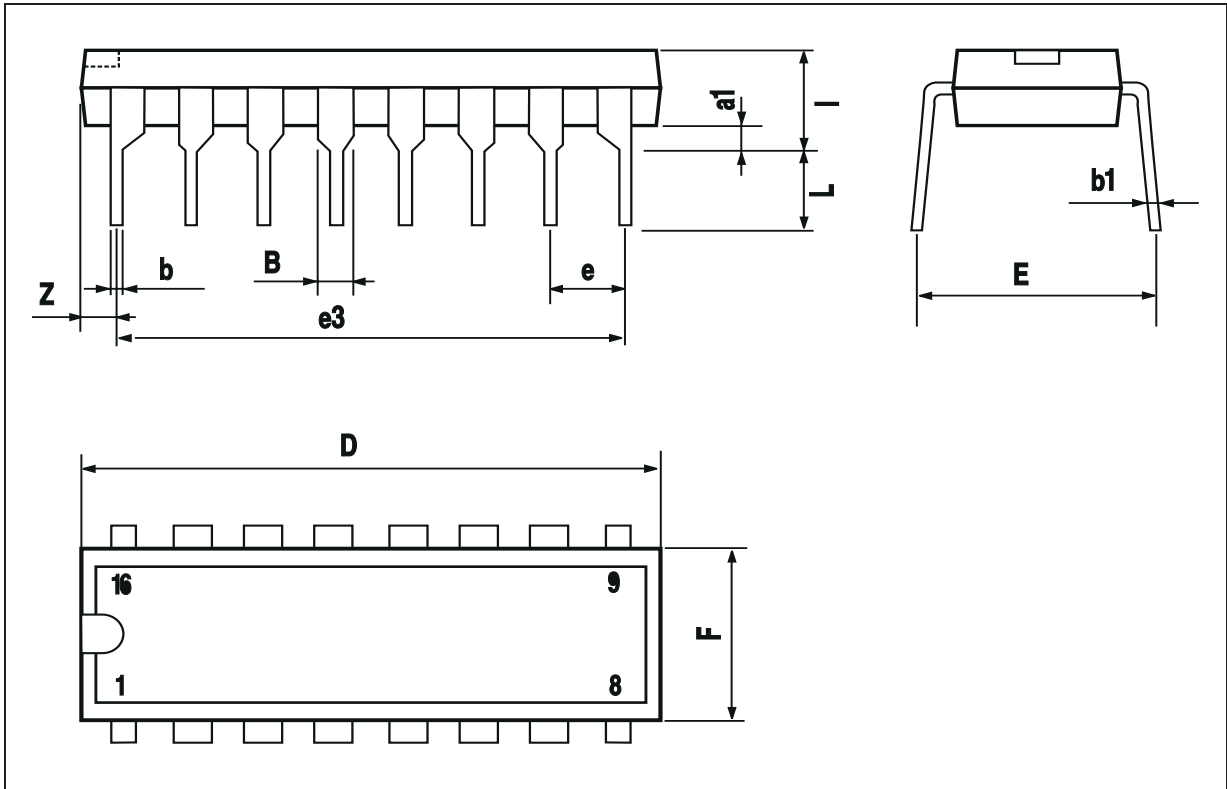
**TEA2025B - TEA2025D**

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
a1	0.51			0.020		
B	0.77		1.65	0.030		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		2.54			0.100	
e3		17.78			0.700	
F			7.1			0.280
I			5.1			0.201
L		3.3			0.130	
Z			1.27			0.050

**OUTLINE AND MECHANICAL DATA**



**DIP16**





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